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XXXIII. *A Memoir, containing the History of the Return of the famous Comet of 1682, with Observations of the same, made at Paris, at the Marine Observatory, in January, February, March, April, May, and the Beginning of June, 1759. By Mr. Messier, Astronomer, Keeper of the Journals, Plans, and Maps belonging to the Marine of France, Fellow of the Royal Society in London, and Member of the Society of Sciences in Holland; translated from the French by Matthew Maty, M. D. Sec. R. S.*

Read Jan. 9. 1766. IN the predictions of the heavenly phænomena, which depend on the motion of the stars, two things are to be considered, viz. the time and place. As to the time, when the velocity and direction of the stars in their motions both apparent and real are known, the time of their different appulses and aspects may always be foretold, and the accuracy of the calculations depends on the exactness with which their velocity and their several inequalities are ascertained. Now it is well known that all the former uncertainty, as to the exact time of the return of the comet foretold by Dr. Halley, was owing to the variations it must have undergone from its several situations and approximations to the planets in its progress thro' the solar system.

Dr.

Dr. Halley, who was first aware of the unequal returns of this comet in its former appearances, which he found to have been alternately of 75 and 76 years, was likewise the first who assigned their true cause. He ascribed it, as I said above, to the nearer or more distant approaches of the planets of our system; and having observed that the comet we are speaking of came very near Jupiter in the summer of 1681, above a year before its last appearance, and remained several months in the neighbourhood of that planet, he judged that circumstance alone sufficient to have considerably retarded its motion, and prolonged the duration of its revolution. Hence he concluded that its return was not to be expected till the latter end of 1758, or the beginning of the next year.

Dr. Halley observes, in confirmation of this opinion, that the action of Jupiter upon Saturn is alone sufficient to alter the duration of Saturn's period one whole month; and he adds, how much greater irregularities must not a comet be liable to, which at its remotest distance gets near four times farther from the sun than Saturn, and whose velocity in drawing near the sun needs but a very small increase to change its elliptic into a parabolic curve.

Dr. Halley does not determine more exactly the time of the return of the comet of 1682; neither could he do it but by determining exactly the effect of the neighbourhood of Jupiter, which must very sensibly affect the velocity with which the comet was moving towards the sun. Besides, regard must be had, not only to this approach to Jupiter in 1681, but likewise to the other approaches to this and all the other

other planets, which act more or less upon the comet, as they do upon each other. In short, it was necessary to consider all the different situations and distances of all the planets with regard to the comet, during the whole of its last revolution, and even during the former ones, when the returns had been found to be unequal.

What immense labour ! and what geometrical knowledge did this task not require ? Mr. Clairaut, of the Royal Academy of Sciences, undertook it ; and his results differed but one month from the observation. No small degree of exactness this, considering the immensity of the object. In November 1758, he published his conclusion, which allowed about 618 days more for the period that was to end in 1759 than for the former, whence he inferred that the comet must be in its perihelion towards the middle of April. He added, however, (*Journal des Scavans*, Jan. 1759) " Any one may think with what caution I venture upon this publication, since so many small quantities unavoidably neglected by the methods of approximation may very possibly make a month's difference, as in the calculation of former periods." It accordingly proved so, the comet having reached its perihelion on the 13th of March in the morning. Mr. Clairaut has since published the methods and calculations, by which he has arrived at this conclusion.

The impatience of astronomers, and their desire to prepare for verifying this prediction of Dr. Halley, had put them upon enquiring for several years in what part of the heavens this comet was likely to appear ; but, being ignorant of the exact time of its return,

return, they could not determine the spot where it might be expected to be seen, but by making various suppositions as to the time of its perihelium. This Mr. Dirck of Klinkenberg, a famous astronomer, Member of the Society of Sciences in Holland, and a correspondent of the academy of Paris, had attempted seven or eight years before, having taken the pains to calculate the principal points of fourteen different tract^s, which the said comet was to take, upon as many different suppositions relating to its passage thro' its perihelium, almost from month to month, from the 19th of June 1757 to the 15th of May 1758. Messrs. Pingré and De la Lande proceeded much in the same manner in the calculations they published in the Memoirs of Trevoux for April 1759, first and second parts, with this difference, that the latter in their suppositions had taken narrower limits, and nearer to Mr. Clairaut's determination, who, as I said before, had fixed the return of this comet to the middle of April.

Mr. De L'Isle, being curious of seeing the comet on its first return, as soon as it could be discovered by means of refracting or reflecting telescopes, before it was visible to the naked eye, thought he must proceed in a different manner from what other astronomers had done, to find out in what part of the heavens it must be looked for. He considered that it was not necessary to know its place throughout its whole course, but only at the first moment of its appearance, because, having once found it out, it would be an easy matter afterwards to trace it thro' its whole progress by observation and calculation.

A full description of this method is to be found in an ample memoir concerning this comet, which I have laid before the Royal Academy of Sciences at Paris, and which no doubt will be printed in their collection, together with a northern hemisphere, by means of which I have been enabled to look for this comet in the very place of the sky, where it ought to appear; and it was by the help of this planisphere that I actually discovered the comet from the marine Observatory at Paris on the 21st of January in the evening, after searching for it two years successively whenever the sky would permit. The weather was extremely clear the 21st of January the whole day and evening. I seized this opportunity, and as soon as the stars were visible after sun-set, I examined, thro' a Newtonian telescope of four feet and a half, those places of the sky, where my planisphere shewed that the comet was to be expected. After much pains, I perceived about seven o'clock a light resembling that of the comet I had observed the year before in August, September, October, and the beginning of November *. I immediately made a configuration of this new light with respect to the neighbouring stars, in order to examine the next night whether it had had any motion among the fixed stars. This light appeared pretty large; and in the middle I observed a nucleus, or bright spot, which was no proof as yet that it was a comet, as there are some nebulous stars, with a bright spot in the middle. By the drawing I took of this new light with respect to two neighbouring stars, one of which was the 18th of Pisces, according to Flamstead's Catalogue,

* See Mem. de l'Acad. Roy. des Scienc. An. 1759.

2d edition, of the 5th magnitude, marked with the Greek letter λ , the other a new star of the 8th magnitude, which I ascertained by observation, by comparing it with the above-mentioned star λ of Pisces, its right ascension for the present time being $352^{\text{d}}.$
 $13^{\text{h}}.$ $5''$. and its declination $1^{\circ}.$ $6'.$ $40''$ N. and is the 28th in the catalogue of the stars which have served to find out the position of the comet, which is to be seen at the end of this memoir; at $6^{\text{h}}.$ $56'$ true time, the position of the comet in right ascension was estimated at $352^{\circ}.$ $15'.$ $47''$. and its declination $1^{\circ}.$ $32'.$ $6''$. North.

Jan. 22, at the same hour as the day before, the sky being equally clear, I again saw the same light with the $4\frac{1}{2}$ foot telescope, and found it had sensibly changed its place, but its appearances were the same. From this second observation I no longer doubted of its being a comet; and from this very night I began to take notice of the situation of the nucleus, by comparing it with a small new star which is not to be found in the catalogues, nor in the celestial maps of Flamstead, but is that whose position I have just now mentioned, and which stands N° 28 in the catalogue annexed to this memoir. It was not without some difficulty that I could take the position of the comet with regard to this little star, because I was obliged to throw light upon the threads of a silk micrometer, which was adapted to the Newtonian telescope, four feet and a half long, and the least degree of light from a wax candle I made use of, presently made both the comet and the star disappear. The position of the comet may be seen in the second table hereunto annexed, and likewise all the other positions of

it, which have been determined to the time of its final disappearing.

The 23d, the sky being very clear, I again saw the comet; its appearances were the same as the two preceding days. I compared the nucleus with a very small star, only of the 10th magnitude, which I have settled by comparing it with the 46th star of Pisces of the 6th magnitude, according to Flamstead's catalogue. See the position of this star in the first table, N° 27. The position of the comet is set down in the second table.

The 24th in the evening, the fog, thin clouds, and vapours about the horizon suffered me to take but an imperfect view of the comet; all I could do to get at its situation was to observe the differences of azimuths and heights of the comet, and the two stars of Pegasus called *Algenib* and *Markab*. These differences did not appear to me to be so exact as to depend upon the determination of the comet from them, so I shall give no account of them.

The 25th in the evening, the sky being clear at times, I again saw the comet; its light was increased, and the nucleus looked brighter than before, but without any appearance of a tail. I compared it directly with a star which is the 16th of Pisces, in the order of Flamstead's catalogue. It was likewise compared with N° 26 of my table. The comet was sufficiently visible this night to be seen thro' a common two feet telescope, and even thro' one of a single foot. At four minutes past seven, the comet was still to be seen thro' the telescope at the height of 13° above the horizon.

The 26th, the cloudy weather prevented my seeing the comet; but the 27th, the sky being tolerably clear, tho' the air was not altogether free from vapours, I again saw the comet, but could form no judgment of its appearances. I compared the nucleus with a new star which is the 25th of my table, which I knew by comparing it with some stars in Flamstead's catalogue. I also directly compared the nucleus of the comet with the 16th star of Pisces. See the second table.

The 28th, the sky being pretty clear in the evening, I began to see the comet at $26\frac{1}{2}$ above the horizon; but the air was so much darkened by some fire-works which had just been played off at the Prince of Condé's, that I could neither judge of its shape or brightness. All I could do was to compare it three times with the new star mentioned above, N° 25 of my table, and once with the 16th of Pisces.

The 29th and 30th it was too cloudy to see the comet, but the 31st it cleared up a little; the comet appeared between the clouds, though not plain enough to judge of its increase, but only to compare it with two stars, which are not in Flamstead's maps, nor mentioned in his catalogue, but are not far from the star k of Pisces of the 5th magnitude, with which I compared them. They are both set down in the first table, N° 23 and 24.

February 1, the sky being perfectly clear in the evening, the comet appeared, notwithstanding a strong twilight and the neighbourhood of the moon. I compared the nucleus with the same two new stars, N° 23 and 24. The clearness of the air this night induced me to measure the diameter of the coma of

the comet with the micrometer adapted to the Newtonian telescope, and I found it 2 min. and $\frac{1}{4}$. I likewise determined the magnitude of the nucleus, which I found to be 20'', having compared it with the thickness of one of the threads of the micrometer, which I afterwards reduced into parts of the micrometer. The twilight was then such as to favour this measuring and the other observations.

The 2d the clouds prevented my seeing the comet, but the 3d, about seven o'clock, the sky being tolerably clear, the comet appeared, though but faintly, by reason of its nearness to the horizon and of the light of the moon; however, I compared it with a star of Pisces that is to be found in Flamsteed's catalogue. It is the 8th of that constellation, marked with the Greek letter κ' . The position of this star for the present time is shewn in the first table.

The 4th I was as much hindered as the night before by the comet's nearness to the horizon, and by the too great light of the moon, which made it impossible to judge of its increase. I compared the nucleus with the same star κ' of Pisces.

From the 4th to the 11th it was utterly impossible to make any observations, or even to see the comet, by reason of the clouds which darkened that part of the sky at the time it should have appeared. The 13th the sky was clear in the evening. I saw the comet, which was but 10° high, so that I could not judge of its appearances, from its nearness to the horizon, and the strong light of the moon, which was then at the full. I was likewise much obstructed by the height of the chimneys which stand between the horizon and the marine Observatory to the West.

This prevented my comparing the comet with the neighbouring stars for a quarter of an hour that it continued visible. All I could do was to draw the configuration of these stars with the comet, both with the four feet and half telescope and with a little two feet refracting telescope, which was fastened over the reflector in a parallel situation. From this configuration, I have estimated the position of the comet, as is seen in the second table.

The 12th, the sky, which had been cloudy all day, cleared up a little in the evening. The comet appeared near the horizon for a few minutes, but was soon hid behind the chimneys. All I could do was to estimate its position relative to the neighbouring stars.

The 13th, the sky was quite overcast; but the 14th having cleared up in the evening, I could see the comet, but close to the horizon, at the height of 6° for a few minutes; and it soon disappeared, being intercepted by terrestrial objects too high above the horizon, and which I could not keep clear of. All I was able to do in the short interval it was visible, was to take a hasty estimate of its position with respect to the star A of Pisces. The brightness of the twilight prevented my seeing the comet earlier.

The 15th and the 17th, the sky was pretty clear in the evening; but I could not see the comet at all, because of the bright twilight, which continued till the setting of the comet.

The comet being no longer visible at night, on account of its getting into the sun's rays, Mr. De L'Isle and I examined the exactest observations I had made, which helped us to determine the time and
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the place of the sky, where it was to re-appear in the morning, when it should get clear of the rays of the sun. This was to happen towards the end of March; but the cloudy weather, which prevailed at Paris during that month, prevented our seeing it again. Besides this inconveniency, the marine Observatory did not stand high enough to see it at its first rising in the morning. We were obliged to look out for a more convenient place in the neighbourhood, and met with one at the house belonging to the College of Lewis the Great, where there is a turret which overlooks all the horizon, and where Father Merville, Professor of Mathematics, makes his observations. The 31st of March I removed thither my $4\frac{1}{2}$ feet Newtonian telescope, and likewise a pendulum clock.

I spent the night from the 31st to the 1st of April in this turret with Mr. De L'Isle. At three in the morning, I began to trace a meridian upon the floor by means of a sea-compass; and I likewise drew a line, which made an angle of about 74° with the meridian, from the South towards the East, in the direction of which the comet was first to appear. I directed the Newtonian telescope according to this line; and at 52 minutes past three I saw the comet, about two degrees above the horizon. It appeared much larger and brighter than in the middle of February; and indeed it was but 18 days past its perihelion. Now it is well known that comets are much brighter after the perihelion than at the same distance before it. Besides, the comet after passing the perihelion was as near again to the earth as on the 14th of February, when I lost sight of it at night.

night. When I saw this comet again on the 1st of April, I could very plainly discern its tail, but could not ascertain its length, because of the morning twilight which was then beginning, and soon increased much; it filled the field of the telescope, and must have extended far beyond. According to what I have observed, the tail of the comet must have spread to more than 25 degrees. The nucleus was considerable, but not well terminated, and it apparently exceeded the size of stars of the first magnitude. It was of a pale whitish colour, not unlike that of Venus. The nebulosity which surrounded the nucleus, and went on lessening, shewed reddish colours, and these colours grew more vivid towards the brightest parts of the tail. The morning twilight, which increased apace, soon put an end to these appearances, and afterwards made the comet itself disappear; however, I had been able to perceive it with the naked eye when it was somewhat disengaged from the vapours of the horizon. In this short interval, I had but just time to observe the shape of the comet with the telescope, and to compare the nucleus with a star which I have since found to be the 30th of Aquarius, according to Flamsteed's catalogue, where it is set down as of the 6th magnitude. The difference of declination between the comet and this star was only estimated. The true time of this observation, which will be found in the second table, has been concluded only by means of a minute watch, which had been set to the true time in the evening by the clock of the marine Observatory. This was likewise the case with respect to the observations made during the month of April, in the turret of

the College of Lewis the Great, where there was a pendulum clock, as I said before, set by a watch which was regulated every day of observation.

I saw the comet the 2d of April in the morning, a little before four o'clock, about 4° above the horizon. The tail did not then appear so plain as the day before. Whether the twilight was stronger, or the horizon more incumbered with vapours, I could see none of those colours in the tail which I had observed the day before. I compared the nucleus in the twilight with a fixed star which was nearly in the same parallel with the comet; it is the 22d of the first table, and I judged it to be of the 7th magnitude.

The 3d, 4th, and 5th, I saw nothing of the comet; but on the 6th in the morning I looked for it through the telescope, as it was no longer visible to the naked eye, from the great strength of the twilight at its first rising. I began to see it at above a quarter after four, about 6° above the horizon. I compared the nucleus with a new star, which I have judged to be of the 7th magnitude. Its position at that time is set down in my first table, N° 21.

April 7, in the morning, the sky not being perfectly clear, I saw the comet a little before four; the appearances were not so plain as for some days past. I compared the nucleus with a new star which I judge to be of the 7th magnitude. The determination of this star may be seen in the first table, N° 20, and that of the comet in the second.

The 8th in the morning, the sky being almost totally overcast, I saw the comet for a few minutes through some little intervals of the clouds, at near $4\frac{1}{2}^{\circ}$ above

above the horizon. All I could do towards ascertaining its position, was to estimate it with respect to the new star of the day before, N° 20.

The 9th, at 4^h 23' in the morning, I again saw the comet through some thin clouds; but the shortness of the time it was visible did not permit me to take its position.

The 10th, 11th, 12th, and 13th, in the morning, the clouds prevented my seeing the comet; but having on the 13th removed my instruments to a place still better situated than the turret of the college, though in the neighbourhood, I carried on my observations there till the 2d of May.

April 14, in the morning, I saw the comet again, the sky being very clear, without a cloud, and I was only obstructed by the great light of the moon, which had past the full on the 12th at one in the afternoon. The brightness of this and the twilight prevented my seeing the comet at its first rising. I could see nothing of it till three quarters past three, when it was got about 4^d above the horizon. It was hardly to be seen, and the nucleus could not be distinguished from the coma, so that the comet looked but like a faint round speck of light. It was then near the stars of the 3d and 4th magnitude, called by Bayer γ and δ of the tail of Capricorn, pretty close to the westermost of these two stars. I had not time to take the distance by the micrometer, the twilight having quickly made the comet disappear. All I was able to do, whilst it was visible, was to determine its situation with tolerable exactness, by means of the differences, azimuths, and heights of the comet, and the two stars of Aquarius's shoul-

ders, and to estimate the position of the comet with respect to the star δ of Capricorn. I have set down this estimate in the second table. It is more to be depended on than the determination by the azimuths and heights.

In the night between the 14th and 15th, it being cloudy most part of the night, I saw the comet between the clouds; but the twilight and the moon prevented my observing its appearances. The nucleus was but imperfectly terminated, and surrounded with a whitish nebula of small extent. I compared the comet in right ascension with the star δ of Capricorn. The difference of declination was only estimated. At 19 min. past 4, the comet disappeared in the twilight, being then but 8° above the horizon.

The weather was overcast in the morning of the 16th; but the 17th, the sky being perfectly clear, the comet began to appear soon after three quarters past three in the morning, being but about $2\frac{1}{2}$ ^d above the horizon. It was hardly discernible, on account of the twilight and the height of the moon, and appeared fainter still than the 15th. I compared the nucleus with two stars that were near it. These stars are new ones. I determined their position for the present time, which will be found in the first table, N° 18 and 19. The first was estimated of the 7th, and the other of the 8th magnitude.

The 18th and 19th in the morning, the sky being very clear, I looked for the comet, but could not discover it. The great latitude it was advancing to every day left no room to hope it would be seen any more above our horizon in the morning; but we knew the tract it was to follow in the heavens. It
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was to rise again above our horizon, after having run through several southern constellations with prodigious velocity, and approached the South Pole within 15 degrees. The southern constellations, through which the comet was to pass after coming out of Capricorn, were the Indian, the Peacock, the Bird of Paradise, the Crois and the Centaur, from whence it was to traverse the Hydra with a motion almost perpendicular to the horizon, and finally be lost in the Sextant which lies under Leo. It was only in this last constellation that it was to disappear from our horizon ; and I was preparing for seeing it again, taking the same precautions I had used to descry last year's comet, when it was distant from the sun above twice and a half as far as the sun is from the earth. Hence appears the utility which will arise from these last observations compared with the former made five months before, for ascertaining the true elements of the theory of this comet in this new apparition, and chiefly to find out the alterations which have happened in these elements since the apparition of 1682. They will help us to discover more certainly and demonstratively the effect of the action of the planets upon comets.

Having thus ceased seeing this comet on the 17th of April in the morning, as I before observed, I was eager to seek for it again towards the end of this very month of April, in that place of the sky where I had calculated it must then appear in the evening ; but the bad weather prevented my seeing it till the 29th, when I perceived it near the horizon, through thin clouds, but I was not able to take its position. The 30th the sky was quite cloudy ; but on the first of May

I saw

I saw the comet with the naked eye about nine o'clock at night, coming out of the clouds which overcast the horizon, but which dispersed soon after.

It appeared to the naked eye larger than the stars of the first magnitude, the nucleus surrounded with a great coma. Its light was but faint, like that of the planets seen through the thick vapours of the horizon. It would have appeared brighter but for the light of the moon, which probably prevented my taking an exact estimate of the size of the comet. The nucleus appeared pretty distinct in the middle of the great nebulosity which surrounded it, and spread more to the East by one degree and a half. The same night, May 1st, I compared the nucleus of the comet with two new stars that were just by, which I found to be of the 7th and 8th magnitude. I determined the position of one of these stars by observing it at the meridian with known stars. Its position may be seen in the table, N° 17. All the observations since the 14th of April in the morning were taken from the place I mentioned, near the College of Lewis the Great. The clock I made use of for these observations had been set to the true time only by a minute watch, which I had taken care to set by the clock at the Observatory, so that there may be an error of some minutes in the true times of the observations. As I found by this day's observation that I could observe the comet the following days from the marine Observatory, I caused the Newtonian telescope to be removed thither, as likewise the clock, which however was of no further use for these observations, having from this time made use of that of the Observatory, that is set by the motion

motion of the fixed stars, and goes extremely regular. So that all the remaining observations, down to the total disappearing of the comet, were taken at the marine Observatory.

May 2d was quite cloudy; but the 3d, the weather clearing up at night, I saw the comet between two new stars of the 8th and 9th magnitude. I determined their position for the present time by comparing them with the star ζ^3 of the Hydra in Flamstead's Catalogue. The nucleus of the comet I compared with these two new stars, which may be seen in my first table, N° 14 and 15. That night the comet was distinctly seen with the naked eye; it looked like a little cloud of light, in the center of which was a luminous point, which was the nucleus, and appeared tolerably well terminated when seen through the Newtonian telescope. The moon, which was now in her first quarter, considerably obstructed the appearances of the comet; notwithstanding which, we could distinguish a tail about one degree and a half in length, tending to the East.

The 4th was overcast; but the 5th being perfectly clear in the evening, I saw the comet, but could form no judgment as to its appearances, because of the moon-light. I compared the comet with two stars of Flamstead's Catalogue, which are the 1st and 2d of the Hydra, both marked with the Greek letter ϕ^2 and ϕ^3 , the first of the 6th magnitude, the other of the 5th. The positions of both these stars for the present time may be seen in the first table.

The 6th I again saw the comet. The moon-light still prevented ascertaining its real size. I compared the nucleus with a new star, which I judged to be of the

7th magnitude. I determined its position by observing it several times on the meridian. It is to be found in the first Table N° 12.

The 7th I compared the nucleus of the comet, with a new star, which I estimated of the 7th magnitude. I determined its position for the present time by comparing it with the star ν^2 of Hydra of the 5th magnitude. The position of this new star may be seen in my first Table N° 10.

The 8th I did not see the comet till it was 24° above the horizon. I compared its nucleus with a new star, which I estimated of the 9th magnitude. I found its position by comparing it with some stars. It stands in the first Table N° 11.

The 9th quite clear at night. The comet was upon the parallel of a new star, which I estimated of the 7th magnitude. I determined its position for the present time, by observing it several times on the meridian. It is set down in the first Table N° 13.

The 10th and 11th were cloudy evenings, but the 12th quite clear till 11 at night. I saw the comet, but the full moon greatly lessened its appearances. I compared the nucleus with a new star, which I estimated of the 6th magnitude. I found its position for the present time, by comparing it with some known stars. It is set down in the first Table N° 16.

The 13th the sky was cloudy almost all day, and at night; however, I saw the comet in the vacancies between the clouds. The moon was not yet up. The appearances of the comet were plainer than the night before. It was but just discernible by the naked

naked eye. I compared the nucleus with some very small stars, one of which I found by comparing it with some stars of the sextant. The position for the present time stands in the first Table N° 8.

The 14th clear at night. I saw the comet with the naked eye before the moon was up; it was still equal to the stars of the 4th magnitude. I determined the apparent diameter of the nucleus, which I found to be 27 seconds, by comparing it with the thickness of one of the threads of the micrometer, which was adapted to the Newtonian telescope. I then compared the comet with several stars, namely with two new ones, which may be seen in my first Table N° 6 and 7, and with the 22d of the sextant in Flamsteed's catalogue.

The 15th the sky was quite clear at night. I saw the comet very plain by the naked eye, but could perceive no tail; but I observed one in looking through a refracting telescope one foot long, made of convex glasses, which is very clear, and discovers a great compass of the sky. I made use of it to find out the stars which corresponded with the extremity of the tail, and then I determined the position of these stars with the comet, by means of the micrometer adapted to the telescope, which gave me the length and direction of the tail. I found it to be $3^d \frac{1}{4}$ long. This tail was not visible with the reflecting telescope, no doubt by reason of its too great magnifying power; it only shewed a round and indeterminate light surrounding the nucleus of the comet. I compared the nucleus with the 22d star of the sextant; the position of this star may be seen in the first Table.

The 16th, the sky being as clear as the night before, I saw the comet till its setting. The tail still appeared to me of the same length. The nucleus was again compared to the abovementioned 22d star of the sextant.

The 17th, the sky being clear, I began to see the comet as soon as it was dark. I again saw the tail through the one foot glass, and found it 4° long. I compared the nucleus with the same star as before, and with two new ones N° 1 and 2 of the first Table, one of the 6th, and the other of the 7th magnitude. I determined their positions for the present time.

The 18th, the sky being perfectly clear in the evening, I saw the comet through the one foot glass. The tail appeared a little increased, but its light was very faint, and it was with difficulty I could perceive it at all. I compared the nucleus with the two new stars N° 1 and 2. The positions for the present time may be seen in the first Table.

The 19th still a clear sky. I saw the comet as soon as it was night; its appearances were the same as the evening before. I took the position of the nucleus, by comparing it with the above stars N° 1 and 2.

The 20th the sky was clear in the evening, though with some thin vapours in the atmosphere. The tail of the comet was not so plain to be seen as the night before. The nucleus was lessened and indeterminate; I compared it with the new star N° 2 of the preceding nights, and with two other new ones N° 3 and 5 of the first Table, which I ascertained by comparing them with some stars of the sextant.

The 21st, the sky being clear and cloudless, I saw the comet, and compared its nucleus with one of the three new stars of the night before, viz. N° 3 in the first Table, of the 8th magnitude.

The 22d I observed that the comet visibly grew dim, and indeed it was now constantly drawing farther from the sun and earth; its nucleus was likewise much contracted, and not terminated. The tail was hardly distinguishable with the one foot glass, and terminated at the 41st star of the sextant according to Flamsteed's catalogue. It was found to be a little more than 4° long. The nucleus was compared with the new star N° 3 of the first Table.

The 23d clear sky at night. I began to see the comet as soon as it was dark. Its appearances were the same as the night before. I compared the nucleus with the said new star N° 3.

The 24th the sky perfectly clear. I compared the nucleus with the same new star N° 3, and with another very small new star N° 4 of the first Table.

The 25th a fine clear sky. I saw the comet as soon as it was dark, and compared it with the new star N° 4.

The 26th, the sky was as clear. I again saw the comet. It has now lost much of its light, especially for a week past; the nucleus is no longer distinct, and it is to be perceived through the telescope, only by a stronger light than the nebulosity which surrounds it. I compared the nucleus of the comet with the same star N° 4.

The 27th, a fine sky. I saw the comet as soon as the stars appeared after sun-set. I could scarce

distinguish the tail with the one foot glass ; I judged it to be about 4° long. I compared the nucleus with the same star No 4.

The 28th I could not see the comet before 10 o'clock by reason of thin clouds ; its appearances were greatly diminished ; it is no longer possible to see it with the naked eye (nor indeed has it been so for these several days *). I compared the nucleus with the same star N° 4.

The 29th a cloudy night ; the 30th I again saw the comet, but with great difficulty. Its light was considerably abated, and might be farther eclipsed by that of the moon, which was now near her first quarter ; and it is to be presumed we shall not see this comet much longer. The increasing light of the moon must in a few days prevent its being visible. I have yet been able to compare the nucleus to a new star N° 9 of the first Table. The position of this new star has been found by comparing it with some new stars of Flamstead's catalogue.

The 31st was cloudy, as was likewise the 1st of June. The 2d I saw the comet in the interstices of the clouds, but could not take its position ; but the 3d I saw it again between the clouds, where the sky was perfectly clear. Its light was very dim, and none but such eyes as had been accustomed to see it could have perceived it at all. This was partly occasioned by the neighbourhood of the moon which was past her first quarter, so that this day may be

* It is to be observed here that the comet, on the 28th of May, appeared much of the same size, as when I first discovered it on the 21st of January at night, though somewhat brighter.

supposed

supposed to be the period of its being visible, at least through the Newtonian telescope of $4\frac{1}{2}$ foot, which I have made use of, and which magnifies the diameter of objects about 66 times. I have once more been able to compare the nucleus with a star of the 6th magnitude, which is the 27th of the sextant according to Flamstead's catalogue. Its position for the present time is set down in the first Table.

I looked again for the comet the following days, but in vain; so that the 3d of June put a period to my observations of this comet. The duration of its appearance has been 134 days, reckoning from the 21st of January, when I first saw it from the marine Observatory. All the observations of the comet have been taken with the Newtonian telescope, to which was adapted a micrometer with silken threads, which could be inclined every way, so that it was an easy matter to bring one of the threads to the parallel of the comet; another parallel thread served to take the differences of declination between the comet and the star to which it was compared. At another thread, perpendicular to these, I observed the differences of the passages in right ascension of the stars and the comet. The field of the telescope was about 53 minutes of a great circle.

By this account it appears, that the comet has had three several appearances above our horizon, which M. De l'Isle and I had calculated as soon as I had made my first observations, that is, as early as the month of February.

The first appearance of the comet was in the evening from the 21st of January, to the 14th of February, when I ceased seeing it by reason of its

entrance into the rays of the sun. The second appearance was at the comet's getting clear of the rays of the sun in the morning, after the conjunction with that luminary, which was to take place a few days before its passage through the perihelion. I observed it in the morning from the 1st of April to the 17th, when it entered the rays of the sun a second time. The 3d appearance of the comet was expected to begin a few days after the end of the 2d, when the comet, after being hid below the horizon, might make its appearance above it; I began to see it again on the 29th of April in the evening, but could not take its position because of the clouds. I went on observing it till the 3d of June at night, when I saw it no more. It was then in the sextant. In this last appearance of the comet above the horizon, it was observed by most of the astronomers in Europe.

More minute accounts of this comet will be seen in a memoir which I have presented to the Royal Academy of Sciences at Paris, together with two celestial maps shewing the tract of the comet through the fixed stars during its appearance, which I have traced exactly by my observations. There is likewise annexed to this memoir a collection of all the observations which have been made of this comet, by my own and Mr. De L'Isle's correspondents. These observations have been taken, at the Hague by Mr. Dirck de Klinkenberg, at Leyden by Mr. Lulof, at Montpellier by Mr. de Ratte, at Avignon by Father Morand, at Vienna by the Rev. Father Hell, at Leipsick, at Rome, at Cadiz by Mr. Godin, at Lisbon by Father Chevalier, and at Pondicherry in the East Indies by Father Coeurdoux.

Explanation of the two Tables annexed to this
Memoir.

The first table contains the right ascensions and declinations of the stars, both of the new ones and of those in Flamstead's catalogue, for the time of the observations. It appears from this table, that the comet has furnished me with an opportunity of determining the position of 29 new stars, which were not yet known, and which have served for the determination of the comet.

The second table contains all the places of the comet, as well in right ascension and declination, as in longitude and latitude, concluded from its situation observed relatively to the stars, whether new ones or already known. These are the titles of each column : The 1st points out the days of the month ; the 2d, the true time of each observation ; the 3d, the right ascensions of the comet observed ; the 4th, the declinations ; the 5th, the longitudes observed ; the 6th, the latitudes ; the 7th, the differences of passage in right ascension of the comet and the stars, marked with the sign — when the comet preceded the star or was to the West of it, and with + when it followed the star or was to the East. This difference, according to the sign, being either added to or subtracted from the right ascension of the star set down in the first table, with which the comet was compared, will give its right ascension. The 8th column shews the differences of declination between the comet and the stars, marked likewise with + and —, and which, being accordingly either added to

to or taken from the declination of the star with which the comet was compared, will give its declination. The 9th column contains the magnitude of the stars; and the 10th, which is the last, has Bayer's letters, and the numbers of the stars, either new or taken from Bayer's catalogue, according to their order in each constellation.

The following are the elements of the comet, as computed by Messrs. de la Caille, Maraldi, and De la Lande.

	Mr. de la Caille.	Mr. Maraldi.	Mr. de la Lande.
S. D. M. S.	S. D. M. S.	S. D. M. S.	
Place of the ascending node	1 23 49 0	1 23 49 41	1 23 45 35
Inclination of the orbit —	17 39 0	17 35 20	17 40 14
Place of the perihelion —	10 3 16 0	10 3 16 20	10 3 8 10
Logarithm of the distance at the perihelion —	9,766039	9,766115	9,7670848
Time of the perihelion —	March 12. at 13 41	at 12 57 36	at 13 59 24

Mean time, at the meridian of Paris, the motion of the comet was retrograde.

T A B L E I.

Containing the right Ascensions and Declinations of the Stars for the Time of the Observations of the Comet of 1759, both of the new ones and of those of Flamstead's Catalogue, which have been made use of to find out the Positions of the Comet as set down in the next Table.

Nº of the Stars.	Right ascension.	Declination.	Mag. of the Stars.	
1	149 48 55	6 7 45 S	6	A new Star, the Comet compared May 18. and 19 at night
22	151 25 27	6 52 25	6	A Star of the Sextant, Comet compared May 14, 15, 16, and 17
2	153 25 25	5 50 36	7	A new Star, Comet compared May 17, 18, 19, and 20
3	153 33 8	5 12 52	8	A new Star, Comet compared May 20, 21, 22, 23, and 24
27	153 35 49	3 10 3	6	A Star of the Sextant, Comet compared June 3
4	153 42 34	4 28 35	10	A new Star, Comet compared May 24, 25, 26, 27, and 28
5	153 42 34	5 21 5	10	A new Star, Comet compared May 20
6	153 46 21	7 58 55	8	A new Star, Comet compared May 14
7	153 47 22	7 12 32	10	A new Star, Comet compared May 14
8	153 57 40	8 19 29	10	A new Star, Comet compared May 13
9	154 7 39	4 13 20	10	A new Star, Comet compared May 30
10	154 47 30	12 21 11	7	A new Star, Comet compared May 7
11	154 52 21	11 52 46	9	A new Star, Comet compared May 8
12	154 57 2	13 39 6	7	A new Star, Comet compared May 6
1	156 8 56	15 5. 53	6	A Star of the Hydra φ ² . Comet compared May 5
13	156 8 15	11 1 37	7	A new Star, Comet compared May 9
2	156 43 56	15 37 38	5	φ ³ of the Hydra, Comet compared May 5
14	156 58 8	19 36 31	9	A new Star, Comet compared May 13
15	157 40 41	19 21 39	8	A new Star, Comet compared May 3
16	159 25 32	8 34 41	6	A new Star, Comet compared May 12
17	159 26 5	25 31 55	7	A new Star, Comet compared May 1
17 ¹ .	160 0 28	25 36 24	9	A new Star
18 ²	322 3 15	20 52 19	8	A new Star, Comet compared April 17 in the Morning
19	322 25 3	20 41 56	7	A new Star, Comet compared April 17 in the Morning

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Continuation of the Table of right Ascensions and Declinations.

N ^o of the Stars.	Right Ascension.	Declination.	Magn. of the Stars.	
49	323 25 38	17 12 5	3	δ of Capricorn, Comet estimated April 14 and 15 in the Morning
20	325 10 5	11 26 3	7	A new Star, Comet compared April 7 and 8 in the Morning
21	326 12 50	9 42 0	7	A new Star, Comet compared April 6 in the Morning
30	327 41 29	7 40 52	6	A Star of Aquarius, Comet compared April 1 in the Morning
22	329 11 24	8 41 31	7	A new Star, Comet compared April 2 in the Morning
5	344 4 32	0 48 °N	6	Α of Pisces, Comet compared and estimated February 14
23	348 33 20	1 7 28	8	A new Star, Comet compared January 31 and February 1
8	348 38 36	0 3 40 S	5	κ ¹ . of Pisces, Comet compared February 3 and 4
24	348 49 10	0 32 29 N	8	A new Star, Comet compared February 1
25	349 40 54	1 1 14	8	A new Star, Comet compared January 27 and 28
26	350 44 16	0 50 56	10	A new Star, Comet compared January 25
27	350 52 16	1 5 8	10	A new Star, Comet compared January 23
16	351 0 1	0 44 48	6	A Star of Pisces, Comet compared January 25, 27, and 28
28	352 13 5	1 6 40	8	A new Star, Comet compared January 21 and 22
18	352 26 6	0 25 53	5	λ of Pisces, Comet estimated January 21

T A B L E

T A B L E II.

Containing the Places of the Return of the famous Comet of 1682, discovered at the Marine Observatory at Paris, January 21, 1759, in the Evening, in the Constellation of Pisces: concluded from its Situation observed with respect to the Stars of the former Table.

	Tr.	Tim.	r. ascension observed.	Declinat. observed	Longitude observed.	Latitude observed	Diff. in r. ascension from the *	Differ. in Declin. from the *	*	*
1759.									5°	5°
Jan. 21	6	40	0 352 15 58	1 32 58	24 23 30 48	4 29 44 0	2 53 +	0 26 18 +	8 28	New * . Com. estim.
	6	56	0 352 15 47	1 32 6	23 30 37	4 31 26 0	10 19 -	1 5 13 +	5 18	A of * . Com. estim.
22	6	51	20 351 51 5	1 29 33	23 6 32	4 36 26 0	22 0 -	0 22 53 +	8 28	Star above
23	7	5	37 351 26 31	1 25 28	22 42 16	4 42 23 0	34 15 +	0 20 20 +	10 27	A new Star
	7	10	9 351 26 1				0 33 45 +		10 27	the same
25	6	58	54 350 38 9	1 13 57	21 53 10	4 50 53 0	21 52 -	0 29 9 +	6 16	of Pisces
	7	6	9 350 39 1				0 21 0 -		6 16	the same
27	6	22	31 349 54 47	1 14 30	21 54 8	4 51 0 0	5 15 -	0 23 34 +	10 26	New
	7	6	1 349 54 47	1 4 48	21 9 31	4 59 34 0	13 53 +	0 3 34 +	8 25	New
28	6	38	0 349 53 1	1 4 36	21 7 51	5 0 5 1	7 0 -	0 19 48 +	6 16	of Pisces
	7	6	1 349 52 0	1 4 52	21 6 59	5 0 43 1	8 1 -	0 20 4 +	6 16	the same
	6	0	56 349 33 1				0 7 53 -		8 25	New
	6	0	56 349 32 54	0 59 54	20 47 23	5 3 4 0	8 0 -	0 1 20 -	8 25	the same
	6	21	50 349 32 1	0 59 44	20 46 38	5 3 47 0	8 53 -	0 1 30 -	8 25	the same
	6	21	50 349 31 46	0 59 38	20 46 25	5 3 51 1	28 15 -	0 14 50 +	6 16	of Pisces
31	6	57	28	0 45 1						
Feb. 1	7	15	31 348 25 40	0 44 25	19 39 12	5 15 49 0	23 30 -	0 22 27 -	8 23	New
	5	48	12 348 5 35	0 40 25	19 19 4	5 20 0	0 27 45 -	0 11 56 +	8 24	New
	5	50	20 348 5 42				0 27 38 -		8 23	the same
	5	52	26 348 5 50				0 27 30 -		8 23	the same
	6	52	40 348 5 30	0 39 57	19 18 46	5 19 33 0	43 40 -	0 7 28 +	8 24	New above
3	7	6	46 347 25 6	0 31 20	18 38 5	5 27 28 1	13 30 -	0 35 0 -	5 1	* . of Pisces
4	6	39	56 347 5 6	0 26 58	18 17 52	5 31 15 1	33 30 -	0 30 38 -	5	the same
11	6	31	30 344 42 20	0 2 20	15 56 2	6 4 0				Comet estimated
12	6	20	0 344 18 50	0 6 0	15 30 59	6 5 22				Estimated again
14	6	30	0 343 41 20	0 15 47	14 52 22	6 10 47			6 5	A of Pisces
Mar. 3	16	47	0 328 0 33	8 25 36	27 16 40	4 15 40 0	19 4 + 0	44 44 +	6 30	of Aquarius

Continuation of the Table of the Positions of the Comet.

Tr. Time.	r. ascension observed.	Declinat. observed	Southern.	Longitude observed.	Latitude observed	Differ. in r. ascension from the *	Differ. in Declin. from the *	*	*		
						M. of	d. of	M. of	d. of		
1759.											
April											
16 16 16 16	11 34 26 19	0 327 44 35 26 26	8 44 30 25 26 25	7 26 55 33 57 57	7 33 1 28 52 1	7 45 0 53+ 16 30+	7 36+ 0 43 30+ 0 26 40-	7 22 7 21 7 20	New New New		
16 28 16 20	26 51 10 5	0 326 10 35	23 10 59 35	9 24 57 28	9 22 1 53 28	9 16 0 0	9 0 9 7+	7 20 7 20	the same the same Com. est.		
13 16 16 16	10 14 1 1	0 323 58 57 24	53 35 38 17	35 35 40 49	35 20 51 57	35 54 2 29	33 15+ 0 1 0	36 30- 0 37 11+	3 49 3 49	δ of 19. Com. estim. Comet by azimuths & of 19. decl. estim.	
16 16 16	6 12 14	0 322 2 2	30 38 1	21 13 0	17 38 44	5 56 45	0 0 45	0 20 41+	8 18	A new Star	
							0 1 15		8 18	the same	
							0 1 30		8 18	the same	
May											
16 9. 27 9. 36	15 27 10	0 322 1 59 159	29 51 50	21 20 42	15 3 6	8 5 22 27	5 58 23 25	23 34+ 0 25 15+	7 19 7 17	New New	
						8 28 30	23 27 28	0 11 11+		the same.	
9. 43 10. 0. 10.	51 11 43	159 50 46	16 25 12	29 38 25	49 3 25	8 22 27	0 24 37+	0 9 48+	7 17	the same	
						8 27	31 25 31			the same	
9. 43 10. 0. 10.	51 11 43	159 50 46	16 25 12	29 38 25	49 3 25	8 22 27	0 24 37+	0 9 48+	7 17	the same	
3 9. 8. 5. 8.	58 49 44 11	7 157 25 28 156 2	25 31 19 34	31 33 41 33	31 19 35 41	17 17 14	9 59 24 28	0 0 15 20+ 0 27 20+	8 15 9 14	New New	
						17	9 31 26 49	10 14 2+		the same	
						17	9 31 26 49	10 14 2+		the same	
8 53 9. 1. 9. 38	30 1 17	156 18 18	1 33 15 33	42 3 30	33 15 34 43	14 14 13	0 33 23 41	20 42 23+ 0 40 38+	5 2 5 2	φ ³ of Hydra the same the same	
						14	0 33 23 41	0 4 35		the same	
						14	0 33 23 41	0 6 55		the same	
9. 50 9. 56 10. 10.	20 19 2 51	156 0 155	0 10 15 59	29 43 55	19 29 15	13 13 13	57 59 23	0 43 46 0 43 13+ 0 44 1-	5 2 5 2 5 2	the same the same the same	
						13	57 59 23	0 8 19		the same	
9. 56 9. 56 10. 10.	19 19 2 51	156 0 155	0 43 15 59	29 47 55	19 29 15	13 13 13	59 23 38	0 43 13 0 44 1-	5 2 5 2 5 2	the same the same the same	
6											
9. 31 9. 39 9. 47	7 155 20 155	30 155	2 14 15	0 9 29	12 12 12	12 50 49 49	22 22 22	8 19 30 38+	7 12 7 12 7 12	New the same the same	
						12	50 49 49	0 21 3+ 0 20 54+		the same	
						12	50 49 49	0 20 17+		the same	
7											
10. 10. 10. 10.	4 13 20 155	155 5 59	12 12 12 12	42 42 42 42	28 28 28 28	11 11 11 11	54 53 53 53	21 21 21 21	48 40 37	7 10 7 10 7 10 7 10	New the same the same the same
						11	54 49 49	48 40 37	18 18 17	0 21 17+ 0 20 59+	the same
						11	53 29	21 21	25 37	0 20 51+	the same
8											
10. 10. 12. 12.	10 43 154 154	46 30 30	11 40 45	37 25 45	37 52	11 10 10	9 24 31 55	20 19 19	36 16 51 34	7 11 7 13 7 13	New New New
						11	9 24 31 55	16 28	1 37 50	0 15 45	
						11	9 39 39	18 18	1 51 55	0 35	

Continuation

Continuation of the Table of the Positions of the Comet.

Tr.	Tim.	r. ascension observed.	Declinat. observed	Longitude observed.	Latitude observed	Differ. in r. ascension from the *	Differ. in Declinat. from the *	*	*
								M.	N.
1759.									
May 13									
14	h 1 1	o 7 11	o 4 "	o 8 1	o 1 11	o 16 3 -	o 16 3 -	10	8 New
	9 24 10	153 53 32	8 3 26	8 51 25	17 35 20 4 8 -	o 16 3 -	o 16 3 -	8	6 New
	8 57 34	153 47 28	7 32 19	8 33 22	17 8 25 0 1 7 +	o 26 36 -	o 26 36 -	6	of the Sextant
	9 45 12	153 47 2	7 30 15	8 32 24	17 6 45 2 21 35 +	o 37 50 +	o 37 50 +	22	
15	10 16 27	153 46 52	7 30 23	8 32 2	17 6 51 0 0 30 -	o 17 51 +	o 17 51 +	7	New
	9 15 17	153 44 25	7 5 40	8 20 1	16 44 50 2 18 58 +	o 13 15 +	o 13 15 +	22	of the Sextant
	11 34 23	153 44 10	7 3 17	8 18 56	16 42 42 2 18 43 +	o 10 52 +	o 10 52 +	6	the same
16	9 54 54	153 41 10	6 41 23	8 7 28	16 23 30 2 15 43 +	o 11 2 -	o 11 2 -	22	the same
17	9 20 47	153 39 18	6 22 10	7 58 14	16 6 21 2 13 51 +	o 30 15 -	o 30 15 -	22	of the Sextant
	10 37 34	153 38 55	6 20 35	7 56 45	16 4 58 3 50 0 +	o 12 50 +	o 12 50 +	1	A new Star
	11 30 26	153 38 40	6 17 22	7 55 46	16 2 0 0 13 15 +	o 26 46 +	o 26 46 +	2	New
18	9 25 51	153 38 25	6 1 0	7 49 13	15 47 20 13 0 +	o 10 24 +	o 10 24 +	7	the same
	9 48 52	153 38 15	6 0 21	7 48 51	15 46 30 3 49 20 +	o 7 24 -	o 7 24 -	6	New above
	10 57 38	153 38 5	6 6 0	7 48 30	15 46 13 0 12 40 +	o 9 24 +	o 9 24 +	7	New above
19	9 19 30	153 37 55	5 44 27	7 42 22	15 31 50 3 49 0 +	o 23 18 -	o 23 18 -	6	New above
	10 28 31	153 37 55	5 43 14	7 41 53	15 30 43 0 12 30 +	o 7 22 -	o 7 22 -	2	New above
	8 56 19	153 38 10	5 28 57	7 36 39	15 17 21 0 12 45 +	o 21 39 -	o 21 39 -	2	the same
21	9 5 41	153 38 38	5 28 13	7 36 47	15 16 30 0 5 30 +	o 15 21 +	o 15 21 +	8	New
	9 33 14	153 38 46	5 27 58	7 36 50	15 16 13 0 3 48 -	o 6 53 +	o 6 53 +	5	New
	9 17 30	153 39 18	5 14 2	7 32 12	15 3 18 0 6 10 +	o 1 10 +	o 1 10 +	3	New above
22	9 34 28	153 40 56	5 1 2	7 28 37	14 50 23 0 7 48 +	o 11 50 -	o 11 50 -	3	New
23	9 42 C	153 42 45	4 49 12	7 25 53	14 38 42 0 9 41 +	o 23 40 -	o 23 40 -	3	the same
24	9 12 25	153 45 7	4 38 22	7 23 59	14 27 47 0 11 59 +	o 34 30 -	o 34 30 -	3	the same
25	10 42 41	153 45 40	4 37 31	7 24 10	14 26 47 0 3 6 +	o 8 56 +	o 8 56 +	4	New
	9 26 57	153 48 2	4 28 23	7 22 57	14 17 26 0 5 28 +	o 12 2 -	o 12 2 -	4	the same
	9 33 58	153 51 21	4 19 33	7 22 46	14 8 0 0 8 47 +	o 9 2 -	o 9 2 -	4	the same
27	9 29 15	153 55 26	4 11 12	7 23 29	13 58 44 0 12 52 +	o 17 23 -	o 17 23 -	4	the same
28	9 20 C	153 59 4	4 3 11	7 23 54	13 49 58 0 16 30 +	o 25 24 -	o 25 24 -	4	the same
30	10 12 49	154 9 9	3 48 15	7 27 52	13 32 22 0 1 30 +	o 25 5 -	o 25 5 -	9	New
June 3	10 1 31	154 26 50	3 26 17	7 36 22	13 5 21 0 51 1 +	o 16 8 +	o 16 8 +	27	of the Sextant